TACOM-ARDEC Fuze Perspective

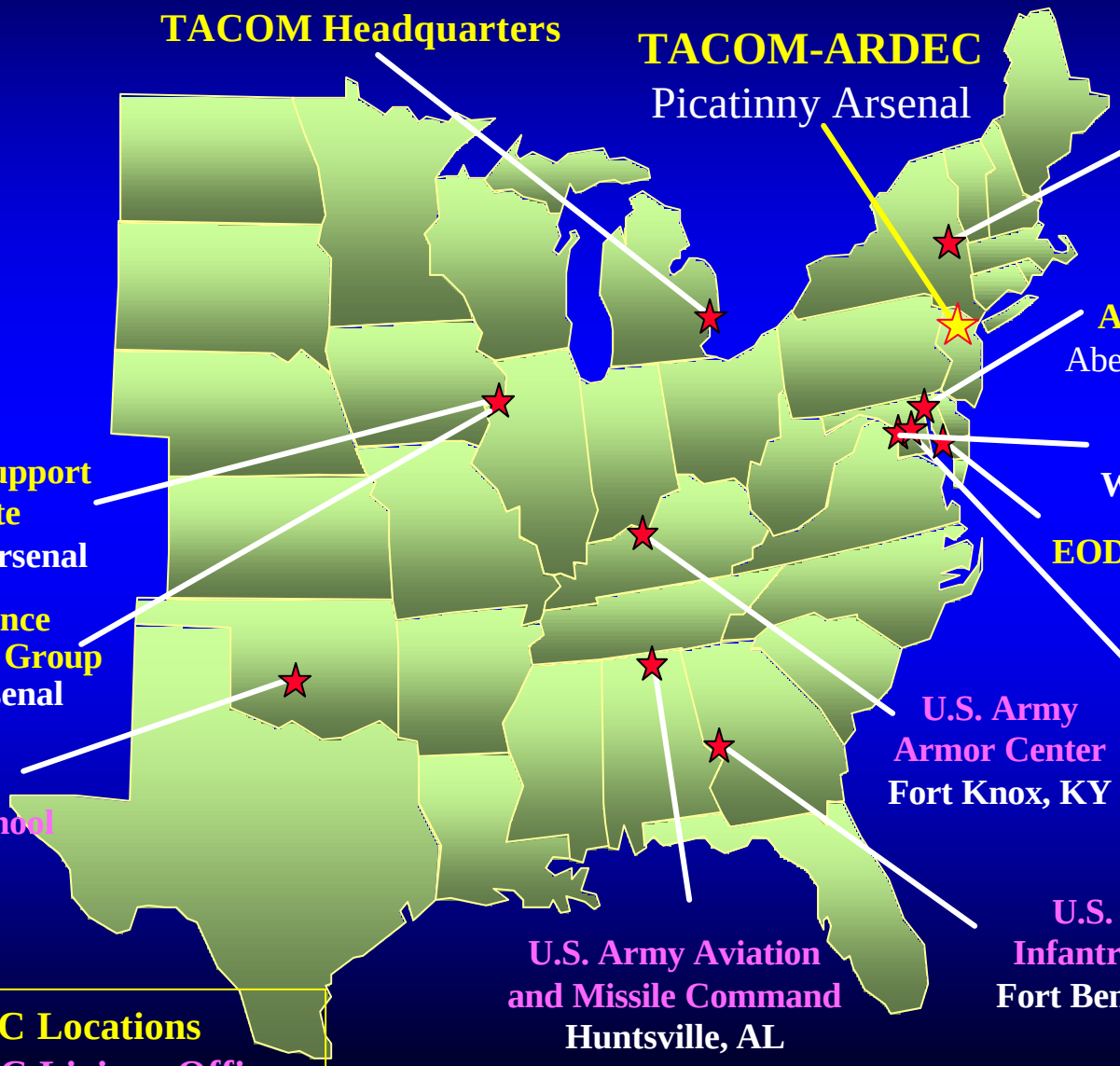
46th Annual Fuze Conference

30 April 2002

COL Michael G. Padgett
Commander, Close Combat Armaments Center

TACOM-ARDEC

DoD
DA
AMC
TACOM



TACOM Headquarters

TACOM-ARDEC
Picatinny Arsenal

Benet Labs
Watervliet Arsenal

Firing Tables and Aeroballistics Branch
Aberdeen Proving Grounds

The Pentagon
Washington D.C.

EOD Technical Detachment
Indian Head, MD

Fuze Division
Adelphi Laboratory Center

Engineering Support Directorate
Rock Island Arsenal

Quality Assurance Product Readiness Group
Rock Island Arsenal

U.S. Army Field Artillery School
Fort Sill, OK

U.S. Army Armor Center
Fort Knox, KY

U.S. Army Aviation and Missile Command
Huntsville, AL

U.S. Army Infantry Center
Fort Benning, GA

TACOM-ARDEC Locations
TACOM-ARDEC Liaison Offices

Picatinny Arsenal

U.S. Army Tank Automotive & Armaments Command (TACOM) Armaments Research Development & Engineering Center

ARDEC

PEO GCS

Program Executive Officer Ground Combat Systems

Program Management

Technology Development

Life Cycle Engineering

PEO Ammo

Program Executive Officer for Ammunition

...And Other DoD Tenants

Organizational Structure

COL Michael G. Padgett

Commander

Close Combat Armaments Center

U.S. Army TACOM-ARDEC

Department of the Army

Army Materiel Command

Tank-Automotive and Armaments Command

Armament Research, Development & Engineering Center

FSAC

CCAC

WECAC

Base Ops

Fuze

Heavy Armament

Light Armament

JSSAP

Benet Labs

AFMO

Core Capabilities

“We Integrate Complex Armament Technologies into Guns, Ammunition, and Fire Control Systems through Research, Development, Acquisition & Sustainment”

- **Smart Munitions (Tank, Artillery, Mortars, Mines)**
- **Fuzes**
- **Fire Control**
- **Combat Vehicle Armament & Ammo**
- **Artillery Projectiles & Platforms**
- **Mortars**
- **Small Arms & Other Soldier Weapons**
- **Mines, Countermines & Demolitions**
- **Less-Than-Lethal Systems**
- **Ammunition Logistics**

FUZE BUSINESS SEGMENT

ARTILLERY/MORTAR FUZES

- Multi Option Prox
- Time
- Safe & Arm Devices
- Inductive Setting

George Eckstein (973-724-4216)
eckstein@pica.army.mil

Tom Crowley (973-724-5678)
tcrowley@pica.army.mil

MISSILE & ROCKET FUZES

- STINGER
- HYDRA-70
- TOW
- BDM
- MPIM

Edwina Chesky (973) 724-2908
echesky@pica.army.mil

CANNON FUZING

- Tank
  - Standoff Fuzing for Advanced Munitions
  - 120MM Tank Munition
- Medium Caliber
  - OICW/OCSW Fuze

Mike Derrig (973) 724-2958
mderrig@pica.army.mil

FUZE TECHNOLOGY

- Proximity Sensors
- Advanced Miniature Antennas
- Signal Processing & Algorithms
- Electronic Safe & Arm
- MEMS (Micro-ElectroMechanical Systems) Safe & Arm
- Simulation & Modeling

Bill Konick (301) 394-3653
wkonick@pica.army.mil

ELECTROMAGNETIC ENVIRONMENTAL EFFECTS

- EM Testing
- ESD Testing
- Nuclear Effects
- Countermeasures Analysis and Evaluation

Paul C. Ng (973) 724-4843
pcng@pica.army.mil

Major ARDEC Fuze Programs

- **Technology Programs**
  - Fuze Technology Integration Program for DCS PRO
  - Tech Base Efforts in support of FCS
- **Development Programs**
  - MEMS S&A
  - Submunition Prox Fuze
  - XM784/785 Mortar Time Fuze
  - Mortar DPICM & PGMM
  - Low Cost Competent Munitions (LCCM)
  - Medium Caliber
    - OICW / OCSW
    - ALACV Bursting Munition
- **Production Programs**
  - M782 Multi Option Fuze for Artillery
  - M762A1 / 767A1 Artillery Time Fuze
  - M734A1 Multi Option Fuze for Mortars
  - FMU 160/B Prox Fuze for High Frag 105mm (AC130 Gunship)

Fuze Technology Integration

- Prox sensors
- Power sources
- Optical fuzing
- Medium caliber fuzing
- Second environment sensors
- MEMS safe and arm
- Electronic safe and arm components
- Self destruct
- Advanced Prox Systems

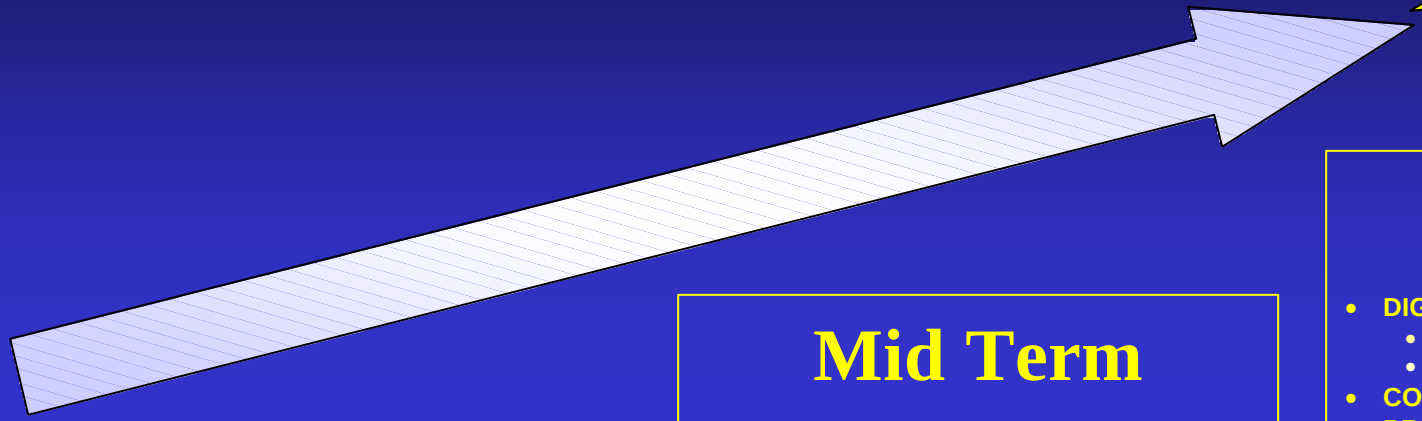
Fuze Technology Funding

	$K(Approx)					
	FY01	**FY02**	**FY03**	**FY04**	**FY05**	
FCS	1,400	400	500	500	500	FND
Fuze Tech Integration		2,000	2,000			FND
				3,000	4,000	UFD
MEMS S&A	800	1,200	1,300	1,200	800	FND
WETC		1,200	2,000	1,700	2,000	UFD
Totals	2,200	3,600	3,800	1,700	1,300	FND
		1,200	2,000	4,700	6,000	UFD

Fuze Technology Contracting Vehicle

- Fuze R&D Contracts through DAAE30-01-BAA-0500 (Broad Agency Announcement)
  - 3 year duration FY01 - FY03
  - Evaluations are conducted quarterly
  - 5 Topic Areas
    - ESA Component Development
    - MEMS Fabrication
    - 2nd Environment Sensors for Non-spinning rounds
    - Inductive Setting with GPS Concepts
    - Proximity Fuze Design Support
  - Two contracts awarded so far

Fuze Technology Progression



Fuze on a Chip

Near Term

- **MEMS S&A**
  - FAB MEMs MECHANICAL S&A ON DIE
  - MICRO ENERGETIC INITIATOR
  - INTEGRATE WITH FUZE ELECTRONICS
- **ESA COST & SIZE REDUCTION**
  - UNIVERSAL ARCHITECTURE
  - LOW ENERGY EFI (LEEFI)
  - PLANAR MAGNETICS
  - MINIMIZE VOLUME REQUIRED

Mid Term

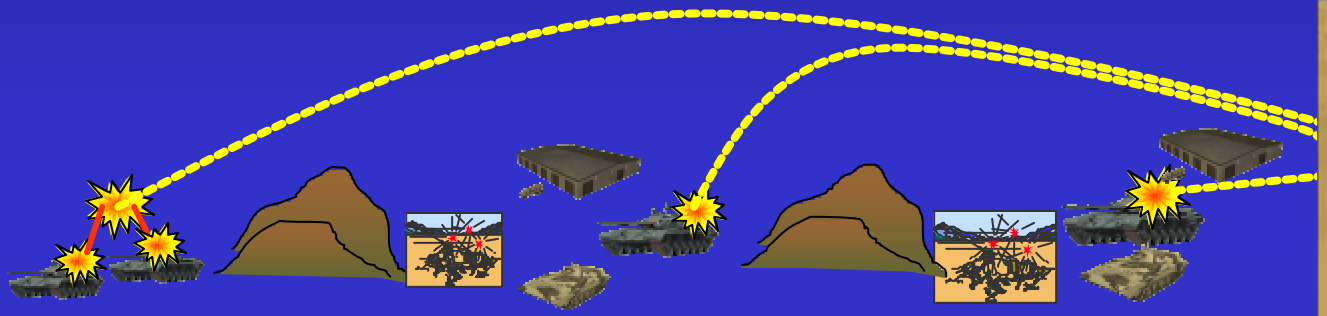
- **ADVANCED PROX SENSORS**
  - SINGLE CHIP TRANSCEIVER & SIGNAL PROCESSORS
  - UWB SENSOR
- **MED CALIBER FUZING**
  - CLUTTER RESISTANT PROX SENSOR
  - AUTOSETTING INTERFACES
  - LADAR FUZE SENSORS
- **ACTIVE PROTECTION SYSTEMS**
  - REACTIVE ARMOR
  - HIT TO KILL

Far Term

- **DIGITAL SIGNAL PROCESSOR**
  - LOW POWER VERSION
  - COMMERCIAL PROCESSES
- **CONVERGENCE OF MEMS AND ADV PROX WORK**
  - FUZE ON A CHIP
  - SMART MICROSENSORS

FCS MULTI-ROLE ARMAMENT & AMMUNITION SYSTEM ATD

Objective: Demonstrate an integrated multi-role armament system providing lethality overmatch capability in the expanded "Red Zone" Close Fight and Tactical Deep Fight, enabling the Objective Force to dominate maneuver throughout the Full Spectrum of Conflict.



"One Shot.. ....At Least One Kill"

"Multipurpose/Precision Point Target Defeat"

NLOS 4-50KM ***BLOS 2-12km*** ***LOS 0-4Km***

Warfighter Payoffs:

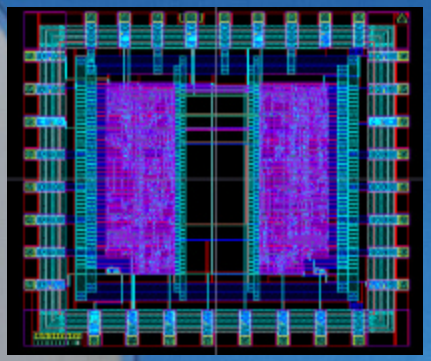
- **Heavy force lethality (LOS, BLOS, & NLOS with high stowed kills) against spectrum of threat**
- **Reduced logistics footprint – through common armament module and single cartridge envelope**

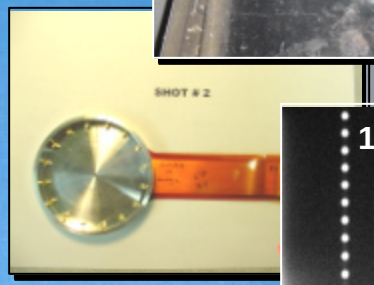
One Lightweight Armament System Capable of Dominating the Red Zone and Beyond

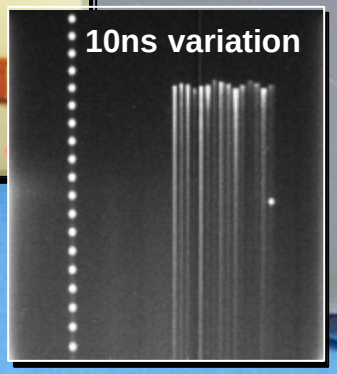
Electronic Safe & Arming (ESA) Efforts

16-point metal on glass shaped charge array.

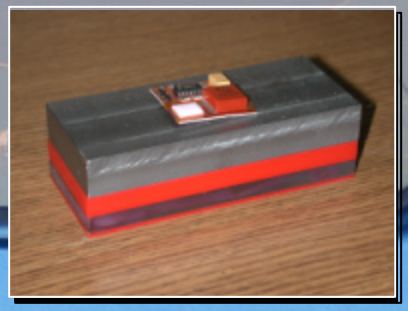
Universal Initiator ASIC for demolition device



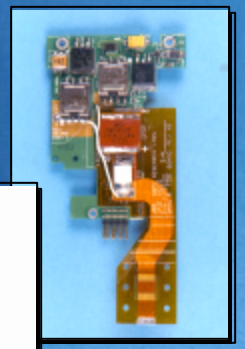




16 point ceramic array.



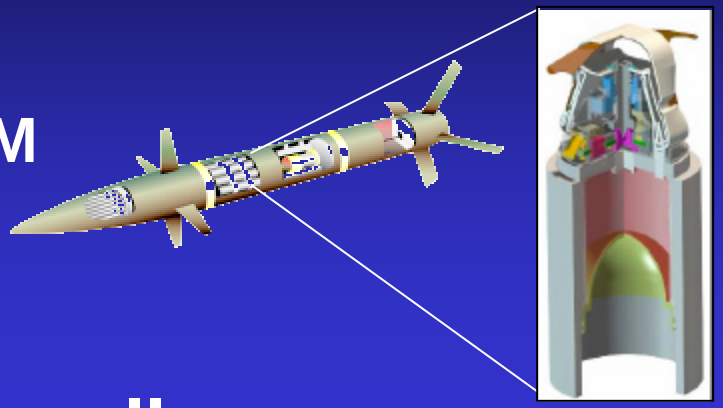
Fire-set for plate launcher



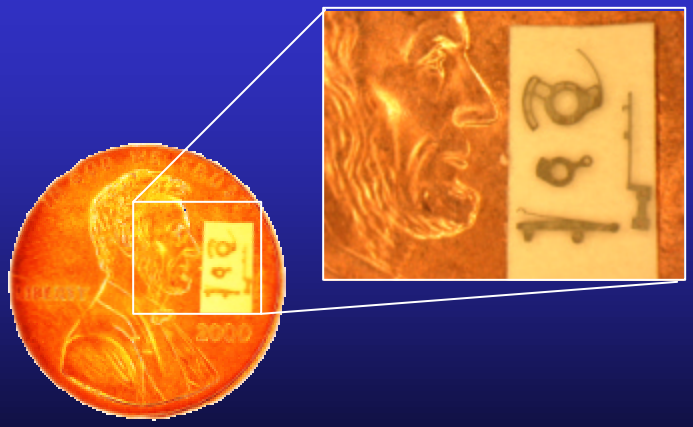
Fire-set for XM153 SYDET

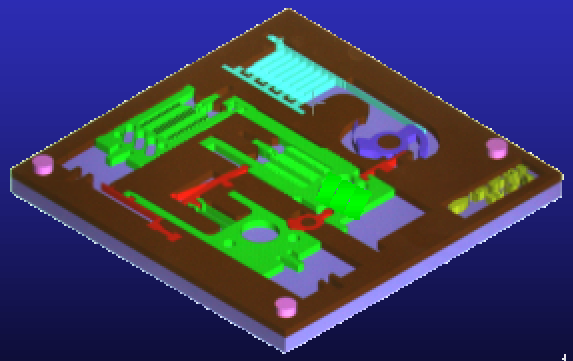
Development Programs

- **Submunitions**
  - **Proximity Fuze for Navy ERGM**
  - **Self Destruct Fuzing**



- **MEMS safe and arming for small caliber applications**

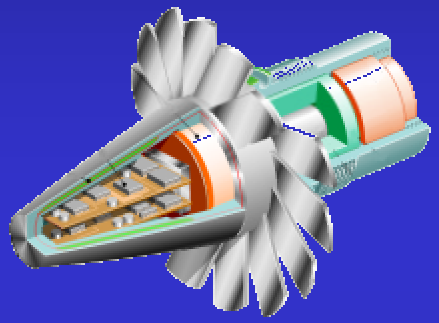




Development Programs (cont.)

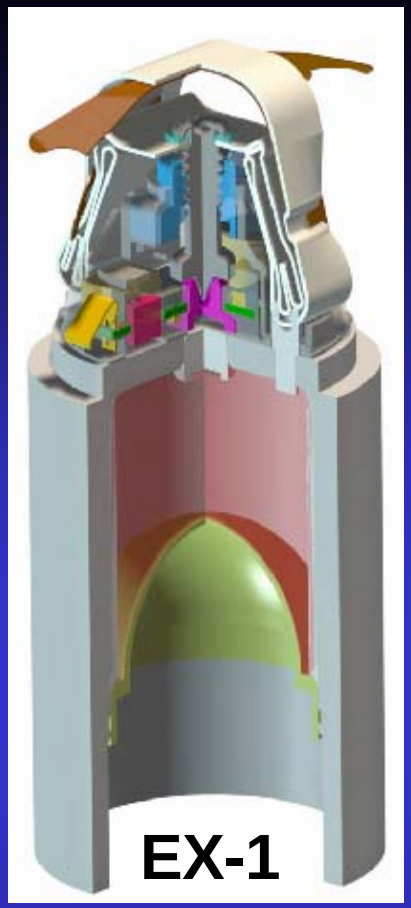
- XM784 / 785 Mortar Time Fuze

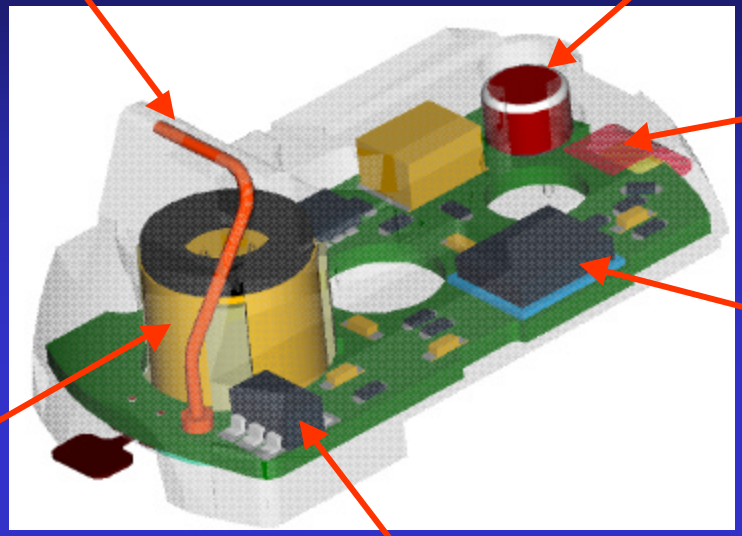
- LCCM



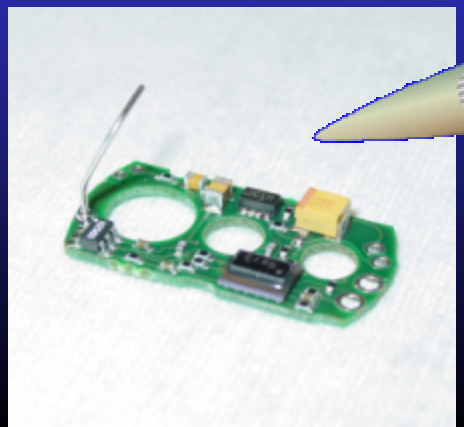
- Medium Caliber – Bursting Munitions

Submunition Proximity Fuzing

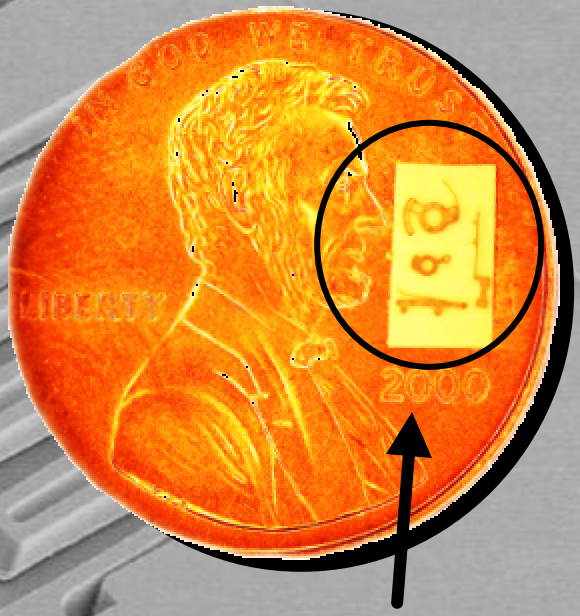




ERGM

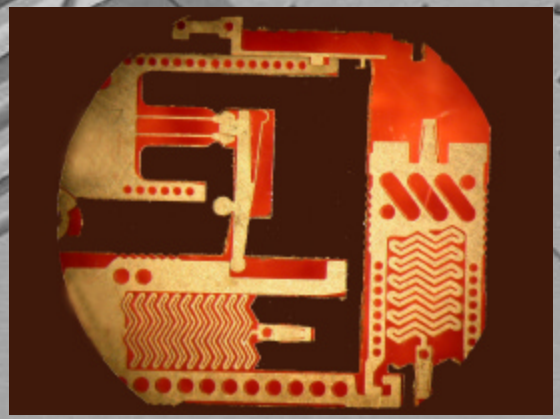


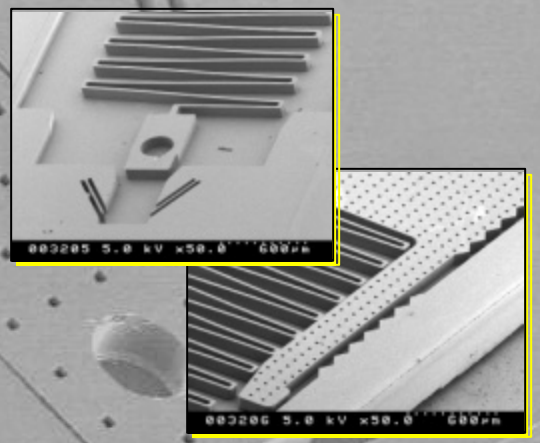
Micro Electro-Mechanical Systems (MEMS) Safe and Arm Device



MEMS S&A Components

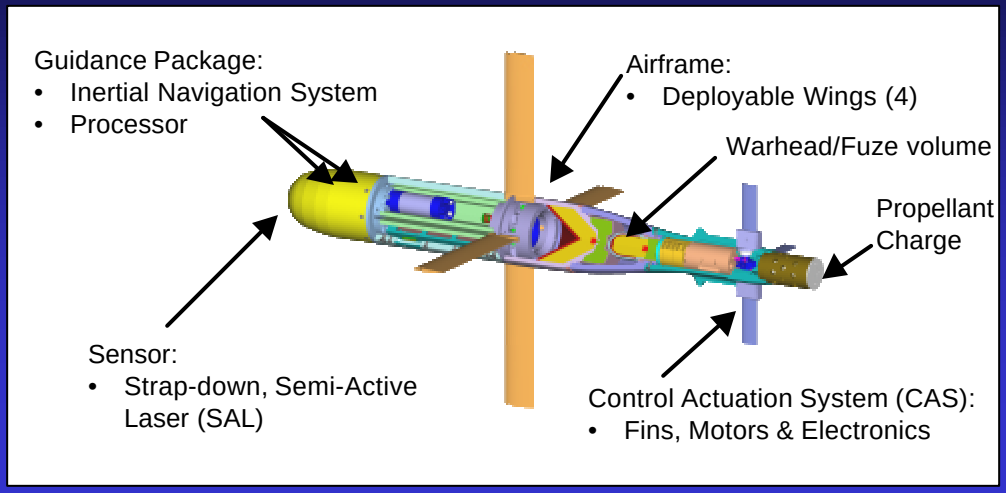
Objective:
Packaged MEMS S&A
< 2 cm3

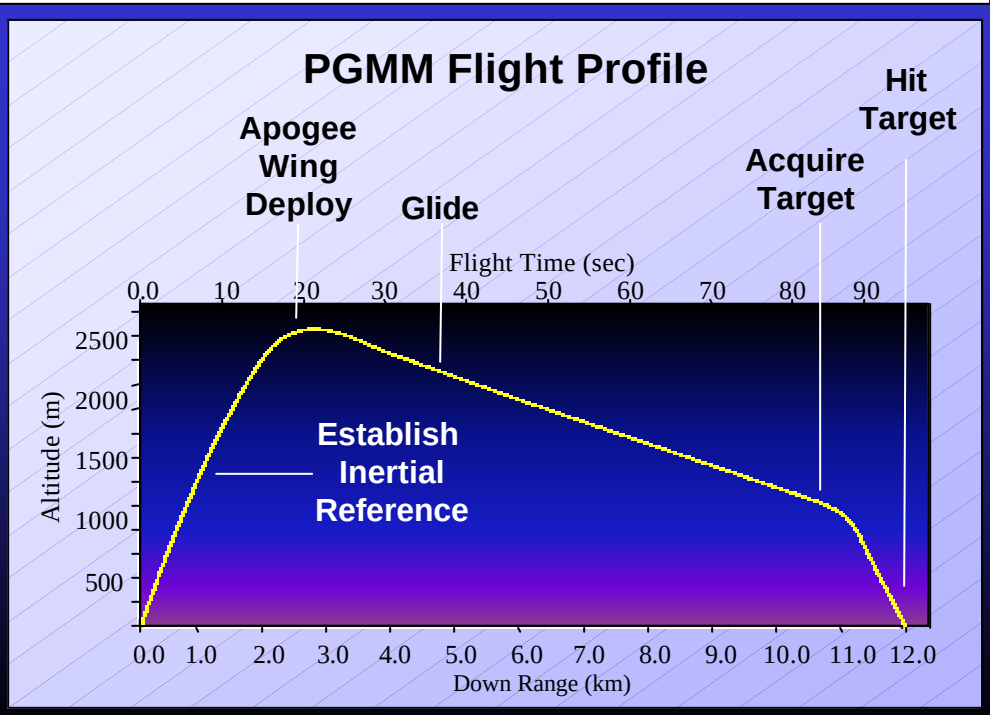




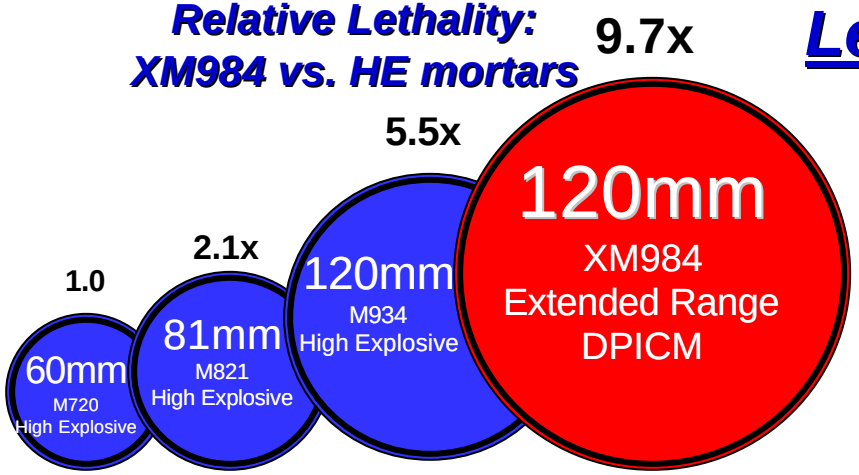
Precision Guided Mortar Munition
DESCRIPTION/MISSION

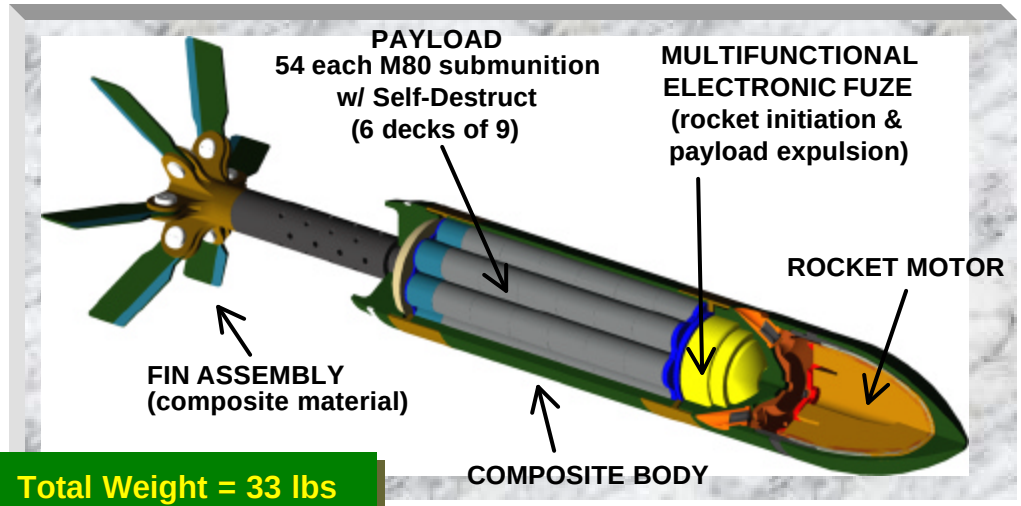
- Operational Sequence
  - ➢Projectile launched
  - ➢Fins Deployed (<30m, 5m demonstrated)
  - ➢Gyros sense in-flight orientation
  - ➢Reach Apogee - Deploy Wings & Glide for Extended Range
  - ➢In-flight corrections made to guide to predetermined “basket” (400m diameter)
  - ➢Search for laser designated target
  - ➢Projectile locks on target
  - ➢Maneuvers to hit target (< 1m CEP desired).





Extended Range Mortar Cartridge
XM984 120mm DPICM





Total Weight = 33 lbs

Lethality Overmatch

System Description

- 120mm Extended Range DPICM

Operational Sequence

- Projectile launched (drop fired)
- Ignition delay, rocket motor activates for Extended Range
- Fuzing delay dispenses M80 Grenades over Target Area
- Grenades destroy wide range of target types:
  - Personnel, Light Skinned Vehicles, Command & Control sites, Ammunition, Fuel, etc...

Performance Parameters

- Range: 10 kilometers (objective)
- Weight: 33 lbs. (not to exceed 10% over standard 120mm HE)

Warfighter Payoffs:

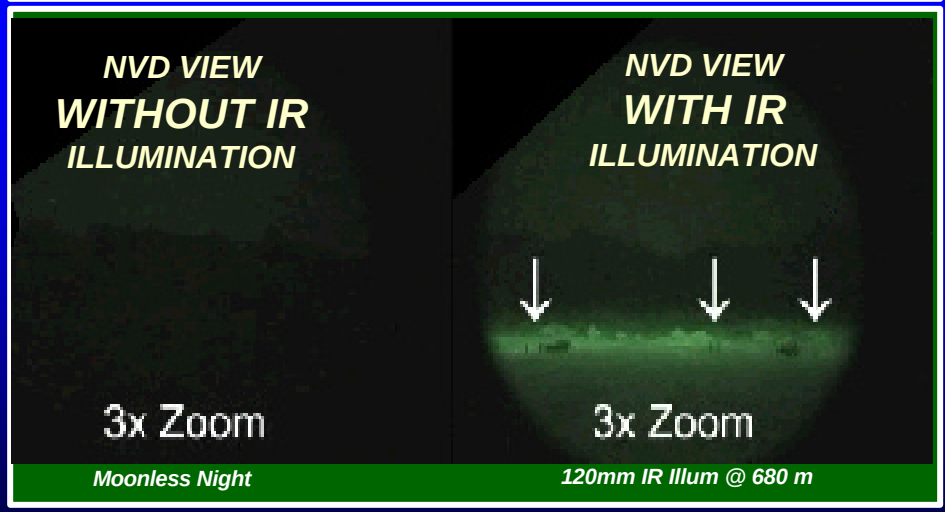
82% Increased Lethality over Standard 120mm M934 High Explosive = Decrease in Logistics Tail

53% Greater Range than Standard 120mm M934 High Explosive = Greater Battlefield Survivability

Mortar Illuminating Cartridges

User Payoff

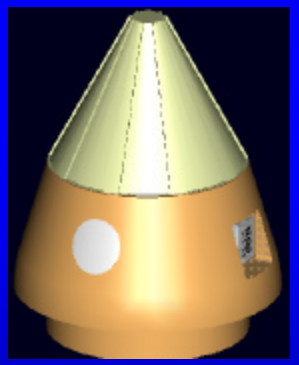
- Illuminate throughout range of HE
- Exceeds ORD burn time
- Sharper Images
- Leverages NVD Capabilities
- Validates “Own the night”



120mm XM930 Visible / M983 Infrared (IR)

ET FUZE

XM784
60/120MM



XM785
81MM

120mm Illum FMR Accelerated 1 Year

The US Army has…The World’s First IR Illuminating Mortar Cartridge

Revolutionary Small Arms Weapons

Objective Crew Served Weapon (OCSW)

- Lightweight/Two Man Portable System
- Overmatching Lethality
- 25mm Air-Bursting Munitions
- Armor Penetration Capability
- Increased Survivability
- 2,000 Meter Effective Range
- Defeats Defilade Targets

OCSW System is **> 60 % lighter** than M2 or MK19

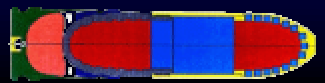
Day/Night Capability

Lethality Component to Land Warrior

Objective Individual Combat Weapon (OICW)

- Dual Munition System:
  - –20mm Air-Bursting Munitions
  - –5.56mm Kinetic Energy Projectiles
  - –Airburst, Point Detonation (PD), PD-Delay &Self Destruct Capabilities
- 1,000 Meter Range
- Defeats Non-Line-of-Sight Defilade Targets
- Transitioned to PM 2QFY00

Airbursting Munitions



Medium Caliber Fuzing

Advanced Light Armaments for Combat Vehicles

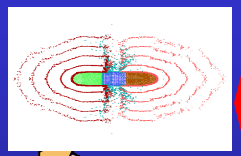
Provide firepower multiplier against troops in the open and in defilade, ATGM sites as well as other area targets through the enhancement and development of bursting munitions and fuzing technology

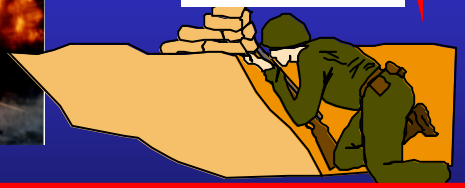
Bursting Munitions

- OCSW/OICW Technologies
- European candidates

KE Rods

- Non-DU Material
- Novel Penetrators
- Improved Behind Armor Effects



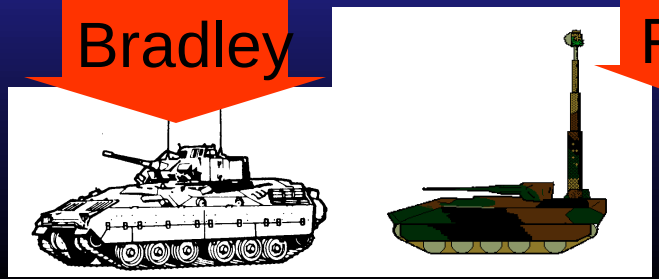


Develop fuzing and advanced penetrator technology applicable to all medium caliber cannons, including Conventional, Supershot and CTA variations

Customer Platforms

AAAV

Bradley



FCS

Production Programs

- **Production Programs**
  - M782 Multi Option Fuze for Artillery
  - M762A1 / 767A1 Artillery Time Fuze
  - M734A1 Multi Option Fuze for Mortars
  - M783 Point Detonating Fuze for Mortars
  - FMU 160/B Prox Fuze for High Frag 105mm (AC130 Gunship)

M782 MOFA

M762A1 Time

M734A1 MOFM

M783 PD

FMU 160 /B

Mortar Fuze Efforts

- Mortar Fuzes in Production
  - M734A1 MOFM
    - Produced ~ 500K, Demonstrated >99% Reliability
    - Contractor L3-KDI, Cincinnati, OH
  - M783 PD/Dly
    - Recently produced and accepted 2nd Production Lot
    - Contractor L3-KDI, Cincinnati, OH

Last Year's Fuze Industrial Base Workshop

- Held May 8 – 10 2001 @ Picatinny Arsenal
- Over 200 participants, 32 companies represented
- A collaborative effort of TACOM-ARDEC, PEO/PM community, OSC, DCS Ammo, OSD, Navy, AF and Marine Corps.
- Impetus for the formation of the DoD Fuze IPT
- Developing/Refining a Strategic Plan for the Fuze Technology and IB

TACOM-ARDEC
The Army's Center for Lethality

"We Are Guns, Ammunition and Fire Control"

Fuzes are a Core Business Area

Postured for the Future

- Lethality to the Troops
- Customer Focused
- Technology Transitions
- Partnering w/ Industry/Academia
- Best Business Practices
- Fast & Efficient
- Focused, Well Trained Workforce
- Unique Facilities
- Aggressive Leveraging
- Established fuze technology base plan